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Hojas técnicas de cálculo:

Transformación bidimensional proyectiva (8 parámetros)

Solución a través del método de Cramer

Versión 1. Febrero de 2015



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Transformación bidimensional proyectiva (8 parámetros)

Solución a través del método de Cramer

Descripción del funcionamiento

Este libro de cálculo contiene una hoja de trabajo llamada 8P Cramer V1 (versión 1, de las disponibles actualmente en www.topoedu.es para este tipo de conversión).

La ecuación del sistema es:

$$X = \frac{a_1x + b_1y + c_1}{a_3x + b_3y + 1}$$

$$Y = \frac{a_2x + b_2y + c_2}{a_3x + b_3y + 1}$$

Esta hoja de cálculo muestra el proceso de resolución de una transformación bidimensional proyectiva (transformación de 8 parámetros) a través del método de Cramer. En ella se utilizan 4 puntos de control. La hoja es capaz de transformar otros 4 puntos adicionales. Como resultado se muestran las coordenadas de los puntos del sistema inicial expresados en el nuevo sistema.

Como opciones adicionales, esta hoja permite:

- Trabajar en el sistema sexagesimal o centesimal.
- Visualizar el formato de coordenadas en XYZ o ENZ.

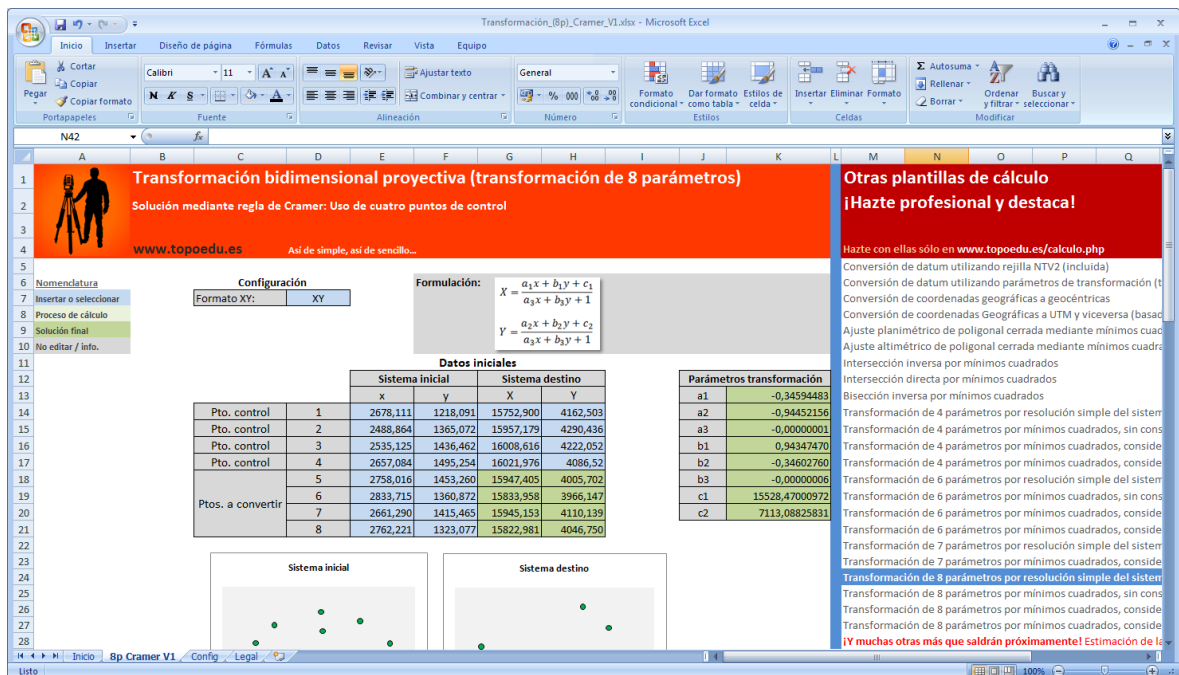


Fig. 1. Captura parcial de la hoja de cálculo



Resolución del ejemplo

Lo primero que ha de hacer es observar la nomenclatura de las celdas a través de la leyenda ubicada en vertical que encontrará a partir de la celda A6. Esta leyenda le informa sobre qué celdas debe modificar, y cuáles no debe modificar y, si fuera necesario, cuáles debe revisar.

Esta hoja se acompaña con un ejemplo ya resuelto.

Supongamos que ya tenemos las coordenadas de los puntos de control insertadas en las celdas E14 a E17, para la X, y F14 a F17, para la Y. Del mismo modo, hemos insertado las coordenadas de estos puntos de control expresadas en el sistema destino, en las celdas G14 a G17, para la X, y H14 a H17, para la Y. También, hemos insertado las coordenadas XY de los puntos a convertir en las celdas E18 a E21, y F18 a 21 respectivamente.

Datos iniciales					
		Sistema inicial		Sistema destino	
		x	y	X	Y
Pto. control	1	2678,111	1218,091	15752,900	4162,503
Pto. control	2	2488,864	1365,072	15957,179	4290,436
Pto. control	3	2535,125	1436,462	16008,616	4222,052
Pto. control	4	2657,084	1495,254	16021,976	4086,52
Ptos. a convertir	5	2758,016	1453,260	15947,405	4005,702
	6	2833,715	1360,872	15833,958	3966,147
	7	2661,290	1415,465	15945,153	4110,139
	8	2762,221	1323,077	15822,981	4046,750

Supongamos también que ha configurado los parámetros de la hoja; formato de coordenadas XY.

Configuración	
Formato XY:	XY

Hecho esto, automáticamente la hoja de cálculo procesa todos los datos mostrando varios resultados:

1. Por un lado, los parámetros de transformación $a_1, a_2, a_3, b_1, b_2, b_3, c_1$ y c_2 en las celdas K13 a K20:

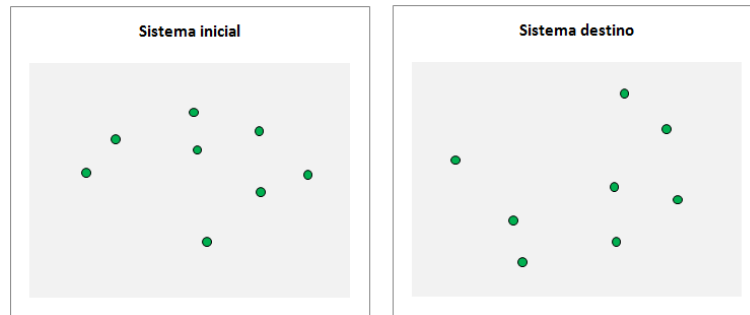
Parámetros transformación	
a1	-0,34594483
a2	-0,94452156
a3	-0,00000001
b1	0,94347470
b2	-0,34602760
b3	-0,00000006
c1	15528,47000972
c2	7113,08825831



- Los puntos transformados, expresados en el nuevo sistema, se muestran en el mismo recuadro general donde insertamos los puntos de control y puntos a convertir. Esto es, en las celdas G18 a G21, y H18 a H21 respectivamente:

Datos iniciales					
		Sistema inicial		Sistema destino	
		x	y	X	Y
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- Un croquis gráfico, con una representación de la distribución de los puntos en ambos sistemas:



- Y, finalmente, todos los determinantes que intervienen en el proceso de cálculo:

<table border="1"> <tr><td>2678,111</td><td>0</td><td>-4,2E+07</td><td>1218,091</td><td>0</td><td>-1,3E+07</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>2678,111</td><td>-1,1E+07</td><td>0</td><td>1218,091</td><td>-5070,907</td><td>0</td><td>1</td></tr> <tr><td>2488,864</td><td>0</td><td>-4,1E+07</td><td>1365,072</td><td>0</td><td>-2,2E+07</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>2488,864</td><td>-1,1E+07</td><td>0</td><td>1365,072</td><td>-5956,754</td><td>0</td><td>1</td></tr> <tr><td>2535,125</td><td>0</td><td>-4,1E+07</td><td>1436,462</td><td>0</td><td>-2,3E+07</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>2535,125</td><td>-1,1E+07</td><td>0</td><td>1436,462</td><td>-6064,817</td><td>0</td><td>1</td></tr> <tr><td>2657,084</td><td>0</td><td>-4,3E+07</td><td>1495,254</td><td>0</td><td>-2,4E+07</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>2657,084</td><td>-1,1E+07</td><td>0</td><td>1495,254</td><td>-6103,85</td><td>0</td><td>1</td></tr> </table>	2678,111	0	-4,2E+07	1218,091	0	-1,3E+07	1	0	0	2678,111	-1,1E+07	0	1218,091	-5070,907	0	1	2488,864	0	-4,1E+07	1365,072	0	-2,2E+07	1	0	0	2488,864	-1,1E+07	0	1365,072	-5956,754	0	1	2535,125	0	-4,1E+07	1436,462	0	-2,3E+07	1	0	0	2535,125	-1,1E+07	0	1436,462	-6064,817	0	1	2657,084	0	-4,3E+07	1495,254	0	-2,4E+07	1	0	0	2657,084	-1,1E+07	0	1495,254	-6103,85	0	1	=	*****								
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Notas

Si usted es docente, y este artículo le ha ayudado a complementar explicaciones y ejercicios de clase para sus alumnos, por favor, sea comprensivo con los trabajos de investigación y cite al autor de este documento y a su web de referencia (www.topoedu.es).